MATHEMATICA one palmer square · princeton, n.j. 08540 · area code 609

OSKAR MORGENSTERN
Chairman of the Board

April 29, 1968

Mr. W. G. Stroud
Code: AA
NASA Headquarters
Washington, D. C. 20546

Dear Mr. Stroud:

A few days ago you asked me to respond to a question you raised regarding reasonable views about discount rates to be applied to NASA project analyses, a matter of critical importance, especially at the present time when illconsidered budgetary decisions may gravely affect NASA's future.

I fully understand the apprehension of your office regarding the demand by the Bureau of the Budget to rank "equally desirable projects" on the basis of their rate of return and in particular in respect to the suggestion by the Bureau to test the economic efficiency of projects for a generalized, all-encompassing 10% discount rate. Implicit in this advice is the indirect threat that any projects which are not able to show conclusively rates of return in the neighborhood of 10% (7.5%, 12.5%) should be prime targets for cuts in government spending. This approach raises serious problems in the field of economic theory, economic policy and particularly with respect to long-term national interest.

In most general terms, the rate of discount measures the degree to which present goods are preferred over future goods. For example, if an individual rates $105 paid one year hence as equal in value to $100 paid right now, then the rate of discount of this person is 5%. Similarly, a community and a government hold similar time preferences which can be expressed and measured in the form of discount rates. This very simple and commonly known device has, however, far reaching and controversial implications. An individual may have fairly clear ideas what his time preferences are; they depend on his present circumstances, his temperament and his expectations for the future. Clearly, it is far more difficult for a community or a government to formulate such preferences.

Few discussions in economic theory rival the rate of discount as a subject exhibiting simultaneously a very considerable degree of knowledge and a very substantial amount of inconsistency. The distinction between social, public and private rates of discount is made in current discussions

(129) MR 514

of the subject. It is widely agreed, though sometimes disputed, that for a variety of reasons (especially indirect effects of public investment) the rate of discount applied to public investments ought to be lower than the rate of return on private investment as will be shown later. The latter rate is at present estimated to be around 12%.

With regard to the level of social (public) discount rates, the economic profession offers a fair amount of divergency. Outstanding economists have offered estimates ranging from 4.0 to 9%, i.e., a divergence of over 100%. Some calculations by governmental agencies, and others for that matter, employ rates of discount as low as 3% or even discount at a 0 (zero) rate.

Given this divergency, it may, however, be stated that economists do agree in general terms as to the nature of the rate of discount: it expresses the opportunity cost of postponement of receipt of benefits yielded by investment, i.e., the loss suffered at present in favor of future and more uncertain gain corresponding to the definition given above.

This discount rate can further be broken down into welfare foregone at present for benefits at some later date and a premium for risk incurred by the investment project. The use of an incorrect rate of discount must lead to very serious misallocations of resources, if such allocations are made on the basis of cost/benefit calculations.

Important in any meaningful discussion of the "just" social discount rate are also assumptions made about the level of employment of all economic resources, risk and uncertainty, taxation, inflation, finance and the rate and role of technological progress. Indirectly, the advice of the Bureau of the Budget of a 10% rate of discount also raises issues regarding the total level of investment within the economy and its allocation between public and private sectors, the role of public investments in "public goods" projects, e.g., education, defense and, of course, research and development projects of national interest. The allocation of private investments will lead to inefficient and nonoptimal total investment if public investment does not complement private interest. This raises grave doubts how effective a single bureaucratically set social rate of discount can be in allocating funds and whether, on these grounds, the social rate of discount is at all a suitable measurement and basis for decision making. This is particularly true in areas of public activity related to education, defense, and national research and development.

It must further be pointed out that there has to be firm knowledge of costs and future benefits of investments in order to be able to apply discount rates, no matter what these may be. Such knowledge is difficult

to establish; there is frequently wide divergency of views especially where future benefits are concerned. This should be considered carefully in applying any firm and often arbitrarily imposed rates.

Without going into a detailed analysis at this point, it is my opinion that any generalized, overall 10% rate of return in all areas of government spending activities would be ill considered and unattainable on theoretical and practical grounds. This would be particularly the case for most activities in which NASA is engaged.

Very sincerely yours,

O. Morgenstern

Oskar Morgenstern

OM:rbp